Table: II

Physio-chemical properties of soil samples

No	Location	Sand	Silt	Clay	Textural Class	ECe 1:5 dsm-1	pH
		in percentage					
1.	Baraki Logar	21.6	51.2	27.2	Clay loam	0.11	8.33
2.	Urgoun Paktia	41.6	37.2	21.2	Sandy Clay loam	0.09	8.33
3.	Shash Q. (Wardak)	31.2	58.4	20.4	Loam	0.13	8.33
4.	Shash Q. (Wardak)	33.2	50.4	16.4	Silt Loam	0.17	8.17
5.	Sayed A. (Wardak)	29.6	45.6	24.8	Loam	0.20	8.45
6.	Giro (Ghazni)	37.2	50.4	12.4	Silt Loam	0.11	8.28
7.	Mohd. Agha (Logar)	22.4	50.0	27.6	Silt Loam	0.14	8.37
8.	Kh. Omari (Ghazni)	35.6	42.4	22.0	Loam	0.11	8.34
9.	Tangi (Wardak)	29.6	53.2	17.2	Silt Clay loam	0.26	8.09
10.	Zana Khan (Ghazni)	37.2	44.4	18.4	Loam	0.21	8.23
11.	Deh Shekh (Logar)	52.2	52.0	22.8	Clay Loam	0.15	8.29
12.	Waghaz (Ghazni)	50.8	34.8	14.4	Loam	0.06	8.13
13.	Moqur (Ghazni)	35.6	50.8	13.6	Sandy Loam	0.09	8.32
14.	Gardez (Paktia)	23.6	48.8	29.6	Clay Loam	0.19	8.23
15.	Waghaz (Ghazni)	21.2	56.4	22.4	Silt Loam	0.10	8.28
16.	Khost Center	15.2	50.4	34.4	Clay Loam	0.19	8.26
17.	Chak (Wardak)	29.6	43.2	27.2	Loam	0.16	8.18
18.	Charkh (Logar)	19.2	56.2	24.4	Silt Loam	0.17	8.13
19.	Kolalgo (Paktia)	45.2	48.4	6.4	Sandy Loam	0.09	8.38
20.	Puli Alam(Logar)	21.2	58.0	20.8	Silt Loam	0.14	8.43

Fertility status of soils under study is reported in table number III.

Table: III

Fertility status of the concerned soils

Sample No.	AB-DTPA Extractable						
	Phosphorus		Potassium		Total Nitrogen	Organic Matter	
	mg kg-1 ppm	Remarks	mg kg-1 ppm	Remarks	%	%	Remarks
1.	5.04	Medium	112	Medium	0.141	2.83	Medium
2.	6.48	Medium	120	Medium	0.179	3.59	High
3.	6.04	Medium	80	Low	0.128	2.55	Medium
4.	6.15	Medium	80	Low	0.158	3.17	High
5.	5.47	Medium	152	Medium	0.096	1.93	Medium
6.	7.82	Medium	70	Low	0.142	2.83	Medium
7.	5.18	Medium	158	Medium	0.165	3.31	High
8.	6.33	Medium	160	Medium	0117	2.35	Medium
9.	5.32	Medium	112	Medium	0.11	2.21	Medium
10.	6.31	Medium	82	Low	0.179	3.59	High
11.	6.12	Medium	82	Low	0.141	2.83	Medium
12.	5.23	Medium	108	Medium	0.159	3.18	High
13.	6.13	Medium	112	Medium	0.19	3.80	High
14.	5.57	Medium	92	Low	0.089	1.79	Medium
15.	6.09	Medium	70	Low	0.162	3.24	High
16.	6.15	Medium	92	Low	0.031	0.62	Low
17.	5.13	Medium	102	Medium	0.114	2.28	Medium
18.	5.97	Medium	78	Low	0.114	2.28	Medium
19.	5.30	Medium	160	Medium	0.181	3.62	High
20.	5.09	Medium	118	Medium	0.130	2.6	Medium

Note: P (ppm), 0 to 3 low, 4 to 7 medium, 8 to 11 high and > 11very high.
K (ppm), < 100 low, 100-200 medium and > 200 high
Organic matter, < 1 low, 1 to 3 medium and > 3 high.
Generally, the percentage of organic matter and ppm of phosphorus reported in table number III, are much higher than the values reported in Afghanistan (9,11).

RESULTS AND DISCUSSION

Yield results from six varieties and 13 fertilizer treatments during 1992-93, nine varieties and eight fertilizer treatments (three replications) during the years 1992-95 are given in table IV-XVIII. The results of the influence of the variety treatments on the yield of wheat are reported in tables IV-X.

Generally, the Attay-85 variety has produced the highest wheat yields in Logar, Wardak and Ghazni provinces during the three years of this study. During the first year, Attay-85 produced significantly the highest yield both at the Moqur and Tangi Stations. The second highest wheat yield at the same stations was produced by the Shaghasti variety. It is worth mentioning that the yield of the local variety at the Moqur Station was not significantly different from that of the Shaghasti variety. There was no significant difference in the yield of local, Pak-81, PS-85 and Cartaya varieties at the Tangi Station . Likewise, there was no significant difference in the yields of the Pak-81, PS-85 and Cartaya varieties at the Moqur Station. According to the data obtained during the first year of the study, the yield of the local varieties were not significantly lower than that of Pak-81, PS-85 and Cartaya.

During the second year, the highest yield of wheat at all of the stations except that of the Moqur Station was obtained by using Attay-85, while the highest yield in the Moqur Station was obtained by the Zardana variety. The yield of Zardana even at the Baraki Station was not significantly lower than that of Attay-85. Zardana has produced the second to third top yields both at the Mohammad Agha and Chardewal Stations.

During 1993-94, the highest yields at all of the stations except that of the Gardez and Zormat Stations were obtained by using Attay-85 variety, while the highest significant yields at both the Gardez and Zormat Stations were obtained by using the Zardana variety. The yield of Zardana variety was not significantly lower than that of Attay-85 at the Moqur Station. Zardana has produced the second highest yield at the Mohamad Agha Station. The yield of local variety at the Moqur Station was not significantly lower than Attay-85 or the Zardana varieties. The yields of local varieties at the Baraki and Gardez Stations were significantly higher than Pak-81. The yield of local varieties were not significantly lower than Pak-81, PS-85, Shaghasti, T-Mutant, Afghan-14, Darul Aman-4 at the Mohammad Agha, Tangi and Zormat Stations.

During 1994-95, the highest yields at all of the stations except that of the Shash Qala were obtained by using Attay-85 while the highest significant yield at Shash Qala was obtained by using Zardana variety. Zardana produced the second top yield at all of the stations except Ghazni Centre, Moqur and Shash Qala. The yield of Shaghasti was not significantly lower than Zardana at Baraki, Mohammed Agha, and Gardez Stations. Marius produced the lowest wheat yield in Baraki, Mohammad Agha and Herat Stations, while the local variety produced the lowest yield only at Ghazni Center Station.

The mean values of wheat as influenced by the varieties at Tangi Station in Wardak and Moqur Station in Ghazni provinces during 1991-1992 are reported In table number IV.

Table: IV

Mean yield values of wheat (seers/j) as influenced by the varieties at Tangi of Wardak and Moqur of Ghazni provinces during 1991-1992

Variety	Yield in Seer/j in Tangi in Wardak province	Yield in Seer/j in Moqur in Ghazni province
Attay-85	155.06 A	107.94 A
Shaghasti	93.26 B	93.18 B
PS - 85	48.31 C	61.31 C
Pak - 81	42.35 C	60.68 C
Local	40.05 C	94.90 B
Cartaya	36.02 C	57.47 C

Note: Mean values of three replications in Tangi and Moqur. Any two means in the same column not followed by the same letter are significantly different at the 5% level of probability.

The highest yields of wheat both in Tangi and Moqur are produced by Attay-85. Shaghasti variety produced the second top yields in both Moqur and Tangi Stations. The yields of local variety at the Moqur was not significantly lower than that of Shaghasti, but the yields of PS-85, Pak-81, and Cartaya in Moqur of Ghazni province and PS-85, Pak-81, local and Cartaya varieties in Tangi of Ghazni province were not significantly different from each other. Generally, the yield of wheat in Moqur district was higher than Tangi.



Wheat data collection in Moqur in Ghazni province. The method of sapling for the number of tillers/sqm is shown here.

The mean yield values of wheat as influenced by the varieties during 1992-93 are reported in table number V

Table: V

Mean yields of wheat (seers/j) as influenced by the varieties in Logar, Wardak and Ghazni provinces during 1992-93.

Variety	Baraki (Logar)	Mohammad Agha (Logar)	Moqur (Ghzani)	Chardiwal (Ghazni)	Tangi (Wardak)
Pak-81	65.42 F	52.14 BCD	21.71 FE	1.57 D	40.14 E
PS-85	71.57 E	47.42 E	22.14 DE	1.43 D	53.57 C
Attay-85	85.57 A	58.29 A	24.14 CD	5.86 A	75.71 A
Shaghasti	74.43 CD	51.72 CD	19.86 CD	6.14 A	63.71 B
Afghan-14	76.43 BC	52.57 CD	19.57 F	1.71 D	52.86 C
T-MUT	75.57 BC	51.00 CD	25.57 BC	2.00 D	55.86 C
Zardana	83.86 A	53.43 BC	31.14 A	5.29 B	53.14 C
Darul Aman-4	68.57 EF	48.86 DE	24.00 CD	2.71 C	36.71 E
Local	79.14 B	55.71 AB	26.86 B	1.57 D	46.29 D

Mean values of three replications in Logar, Ghazni and Wardak provinces. Any two means in the same column and not followed by the same letter are significantly different at the 5% level of probability.

The highest yields of wheat are produced by Attay-85 in Baraki and Mohammad Agha of Logar, Chardiwal of Ghazni and Tangi of Wardak province. The yield of Shaghasti in Chardiwal of Ghazni was not significantly lower than that of Attay-85.



AAEC's second conference in Sayedabad in Wardak province in October 1992.

The lowest yield of wheat in Baraki was produced by Pak-81 while the lowest yield of wheat in Mohammad Agha was produced by PS-85. The lowest yield of wheat in Tangi of Wardak province was produced by Darulaman-4.

Generally, the highest wheat yield was obtained in Baraki of Logar while, the lowest wheat yield was obtained in Chardiwal of Ghazni province.

The mean yield values of wheat as influenced by the varieties during 1993-94 are reported in table number VI.

Table: VI

Mean yield values of wheat (seers/j) as influenced by the varieties in Logar, Wardak, Ghazni and Paktia provinces during 1993-94

Treatment Variety	Baraki (Logar)	Mohammad Agha (Logar)	Moqur (Ghazni)	Tangi (Wardak)	Gardez (Paktia)	Zormat (Paktia)
Pak 81	76.93 E	67.32 C	51.25 C	84.68BC	26.96 E	2.65 B
P5 - 85	87.26 C	69.45 C	46.70 C	89.17BC	31.82 D	4.11 B
Attay 85	128.50 A	84.97 A	63.90 A	128.46A	59.55 B	5.77 B
Shaghasti	99.15 B	68.48 C	47.72 C	104.00B	57.04 B	5.42 B
Afghan 14	76.49 E	70.43 C	42.85 D	76.39 BC	45.92 C	6.56 AB
T-MUT	94.97 B	73.70 C	56.73 B	81.75 BC	48.54 C	6.52 AB
Zardana	81.06 DE	79.54 B	65.45 A	84.50 BC	69.50 A	7.23 A
Darul Aman 4	96.89 B	72.40 C	59.61 B	71.71 C	57.70 B	5.49 B
Local	82.56 D	69.72 C	64.72 A	78.92 BC	49.26 C	6.23 AB

Mean values of three replications in Logar, Ghazni, Wardak and Paktia provinces. Any two means in the same column and not followed by the same letter are significantly different at the 5% level of probability.

Attay-85 produced the highest yield in Baraki, Mohammad Agha, Moqur and Tangi Stations while, Zardana produced the highest yield in Gardez and Zormat in Paktia province.

Pak-81 produced the lowest yield of wheat in Gardez of Paktia province while, Afghan-14 produced the lowest wheat yield in Baraki in Logar province.

Generally, the highest wheat yield was obtained in Baraki in Logar while, the lowest wheat yield was obtained in Gardez in Paktia province.

The mean yield values of wheat as influenced by the varieties during 1994-95 are reported in table number VII.

Table: VII

Mean yield values of wheat (seers/j) as influenced by the varieties in Logar, Wardak, Ghazni, Paktia and Herat provinces during 1994-95

Variety	Baraki (Logar)	Mohammad Agha (Logar)	Moqur (Ghazni)	Ghazni Center	Shash Qala (Wardak)	Gardez (Paktia)	Herat Center
Attay-85	76.85A	71.16A	110.61A	165.69AB	37.28B	70.37A	84.96A
Zardana	68.12B	63.33B	87.93C	154.26D	41.60D	58.35B	72.24BC
Shaghasti	68.12B	61.78B	73.32D	152.56D	22.02D	56.58B	65.63D
Darul Aman 4	54.81C	50.45C	92.76BC	161.76BC	24.44CD	48.18C	60.79E
Marius	26.18D	31.00D	96.65B	15781CD	34.57B	26.15D	*70.77C
Local	51.22C	53.76C	90.04BC	102.58F	35.94B	45.07C	74.79B
Bidi-17	63.28B	64.17B	60.87E	112.53E	13.89E	58.99B	*71.50BC
T-MUT	57.98D	52.26C	76.80D	168.51A	25.16C	49.23C	62.80E

Note: Mean values of three replicatios in Baraki, Mohammad Agha, Moqur, Ghazni Center, Shash Qala, Gardez and Herat. Any two means not followed by the same letter are significantly different at the 5% level of probability.

The highest yield of wheat at all of the stations except that of Shash Qala were obtained by using Attay-85. The second top yields at Baraki, Mohammad Agha and Gardez Stations were obtained by using Zardana and Shaghasti varieties respectively. Marius produced the lowest wheat yield in Baraki, Mohammad Agha and Gardez used Marius variety. The lowest yield at Ghazni Center was obtained by using local variety.

(* Afghan-14 replaced Marius & PS-85 replaced Bidi-17 in Herat.)

The mean yield values of wheat as influenced by the varieties during 1991-1995 are reported in table number VIII.

Table: VIII

Mean yield values of wheat (seers/j) as influenced by the varieties in Ghzani, Wardak and Logar provinces during 1991-95

Treatment Variety	Moqur (Ghazni)				Tangi (Wardak)			Baraki (Logar)			Mohammad Agha (Logar)			Mean		Rank
	91-92	92-93	93-94	94-95	91-92	92-93	93-94	92-93	93-94	94-95	92-93	93-94	94-95	91-94	91-95	
Attay-85	108	48	64	111	155	152	129	171	129	77	117	95	71	111	110	1
Shaghasti	93	40	48	73	93	128	106	149	99	68	103	69	62	95	87	2
Zardana	-	62	66	88	-	106	85	168	81	68	107	80	63	92	88	3
T-MUT	-	51	57	77	-	112	82	151	95	58	102	74	52	91	83	4
Local	95	54	65	90	40	93	79	159	83	51	111	70	54	89	80	5
Afghan 14	-	39	43	-	-	106	76	153	77	-	105	70	-	84	-	6
PS-85	61	44	49	-	48	107	89	143	87	-	95	70	-	83	-	7
Darul Aman 4	-	48	65	93	-	74	79	173	83	55	98	70	50	82	81	8
Pak 81	61	43	51	-	42	80	85	131	77	-	105	67	-	78	-	9
Mean	84	48	56	89	76	106	90	155	90	63	74	74	59	89	-	-

The highest yield of wheat during (1991-95) was produced by Attay-85 variety and followed by Shaghasti and Zardana respectively. The lowest yield was produced by Pak-81. During 1991-95 the highest yield of wheat was produced by Attay-85, Zardana and Shaghasti respectively. Generally, the yields of 1994-95 compared to the other yeaars due to some unfavourable conditions were much lower especially in Logar province.

The highest yield of wheat was produced in Baraki in Logar province during 1992-93 followed by Tangi during 1992-93.

The lowest yield of wheat was produced in Moqur during 1992-93, while, its yield during 1994-95 was much higher than Baraki and Mohammad Agha of Logar province.

Field observations for Tangi Complex trials are reported in table number IX.

Table: IX

Field observations for Tangi complex trials during 1991-92

Varieties	Number of plants/sqm (28/10/91)	% Germination	% Winter killing	Number of ears/sqm	Number of grains/ear at harvest	Weight of 200 grains in grams
Pak-81	296	61	92	118	46	7.15
PS-85	322	74	93	121	42	8.0
Attay-85	350	77	78	341	54	7.75
Shaghasti	253	62	87	171	55	8.62
Cartaya	310	63	94	98	41	7.10
Local	312	43	52	304	27	4.78

Percentage of germination was the highest (77%) for Attay-85, followed by PS-85 and was the lowest for the local variety. The percentage of winter killing was the highest (94%) for Cartaya and followed by PS-85 (93%) and Pak-81 (92%) respectively but the lowest (52%) for local variety. The number of ears/m^2 was the highest (341) for Attay followed by local variety (304) but the lowest for Cartaya. The number of grains/ear was the highest for Shaghasti (55) followed by Attay-85 but the lowest for local variety.

Field observations for Moqur complex trials are reported in table number X.

Table: X

Field observations for Moqur complex trials during 1991-92

Varieties	Number of plants/sqm (12/10/92)	% Germination	Number of ears/sqm	Number of grains/ear at harvest	Weight of 200 grains in grams
Pak-81	43	9	227	31	7.00
PS-85	38	9	214	30	7.71
Attay-85	76	17	310	36	7.08
Shaghasti	56	14	282	38	7.98
Cartaya	30	6	194	32	7.41
Local	74	15	402	27	7.17

Percentage of germination was the highest (17%) for Attay-85, followed by local (15%) and Shaghasti (14%), but the lowest for Cartaya (6%). Number of ears/m^2 was the highest for local variety (402) followed by Attay-85 (310) and Shaghasti (282) respectively, but the lowest for Cartaya (194). Number of grains/ear was the highest for Shaghasti followed by Attay-85 but the lowest for local variety. Weight of 200 grains was the highest for Shaghasti (7.98) but the lowest for Pak-81 (7.0).

* AFGHAN AGRICULTURE EXPERIMENTAL CENTER (AAEC)

FERTILIZER AND SEED TRIALS

IN GHAZNI, WARDAK, LOGAR, PAKTIA and HERAT

PROVINCES OF AFGHANISTAN

INTRODUCTION

Wheat is a member of the grain or cereal crops along with maize, barley, rice and oats.

Wheat has been and is the major crop of Afghanistan. In 1978 it occupied nearly 60% of the total area cropped and there was nearly five times as much area growing wheat as there was maize, the second most important crop in Afghanistan. Wheat occupied half of the irrigated land and most of the rainfed crop land before 1978. Wheat has been and is the basic staple of the Afghan diet.

Afghanistan was a net importer of basic cereals until the mid 1970's with between 400 to 500 thousand MT. required depending upon weather conditions. The wheat imported to Afghanistan is more than 600 thousand MT. annually. Around 1977 wheat production in Afghanistan increased significantly through the use of improved seeds, chemical fertilizers and control of pest and diseases. Afghanistan at that time was self-sufficient in wheat and the yield of wheat was doubled. All of these improvements were stopped during the war and the production dropped again.

Improved wheat yield in some parts of the country where the adapted varieties have been used is even more than 200 seers/j. (1 seer = 7 kgs and 1 jerib = 0.2 hector).

In 1992 according to some unpublished data in some places (Paktia, Logar and Wardak provinces), the highest yield of Attay-85 (not a true winter variety from Turkey), which is suited to higher elevation in Afghanistan was up to 220 seers/j. The colour and taste of its

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* *The Afghan Agriculture Experimental Center (A.A.E.C) was established by CoAR in 1991, and organized the first trials of wheat and fertilizer that autumn. A.A.E.C was set up with the potential for expansion into a wider area of Agricultural Research. The practical aims of A.A.E.C are :*

- *To carry out wheat fertilizer trials in the present project area and to prepare for subsequent expansion of similar trials to other regions of Afghanistan.*
- *To extend the field of research gradually to other agriculture sectors especially horticulture.*
- *To attract the contribution from NGOs. From the beginning AFRANE, NAC and CHA have been associated with the project. From 1991 to 1995 Foundation for Rural Development (F.R.D.) and A.A.E.C. coexisted with CoAR, while practical orientation of A.A.E.C. work gradually became more clearly defined.*

The Moqur Conference in October 1991, the Sayedabad Conference in October1992 and the Baraki Rajan conference in October 1993, were the three decisive steps in establishing the importance A.A.E.C.'s work.

The results of wheat yields as influenced by fertilizer treatments are reported in tables XI-XIV. Generally, the lowest wheat yield was obtained from the plots which received no fertilizer at all (except Tangi Station 1991-92). During 1991-92 generally the yields of wheat at the Moqur Station increased in the order of N0P0, N1P1, N2P2 and N3P2. This indicated that the best rate of fertilizer at the Moqur Station was 30 kgs nitrogen and eight kgs of phosphorus/jerib. Applying only phosphorus at the Moqur Station especially 8 kgs phosphorus/jerib was not economical. The most economical rate of fertilizer at the Tangi Station was 24 kgs of nitrogen/jerib.

During the second year (1992-93) at the Baraki Station the yield of wheat increased in the order of N0P0, N1P1 N2P2 but at the Tangi Station the yield of wheat increased in the order of N0P0, N1P1 and N2P1, and dropped at 8 kgs phosphorus and 24 kgs of nitrogen/jerib.

Application of 5 kgs of phosphorus/jerib compared to control treatment increased the yields of wheat at the Mohammad Agha, Moqur and Chardewal Stations. Application of 18 kgs nitrogen/j compared to controlled treatment increased the yields of wheat at the Mohammad Agha, Moqur and Chardewal Stations. Application of 18 kgs of nitrogen and five kgs of phosphorus /jerib compared to either five kgs of phosphorus or 18 kgs of nitrogen/jerib increased the yield of wheat at the Baraki, Mohammad Agha, Moqur and Tangi Stations. Application of 24 kgs of nitrogen and five kgs of phosphorus/jerib compared to 18 kgs of nitrogen and five kgs of phosphorus/jerib increased the yield of wheat only at the Tangi Station. The most economical rate of fertilizer at the Baraki Station was 24 kgs of nitrogen and eight kgs of phosphorus/jerib while 18 kgs of nitrogen and five kgs of phosphorus/jerib was the most economical rate of fertilizer at the Mohammad Agha Station. Application of 30 kgs of nitrogen and eight kgs of phosphorus/jerib compared to 24 kgs of nitrogen and eight kgs of phosphorus/jerib increased the yield of wheat significantly only at the Tangi Station. Application of potassium fertilizer increased the yield of wheat only at the Moqur Station. This clearly indicated that at the rest of the stations there was no significant response to potassium fertilization.



A view of wheat growth in different plots under different varieties of wheat and different ratios of fertilizers at Tangi in Wardak province.

During 1993-94, application of five kgs of phosphorus/j compared to the control treatment increased the yields of wheat significantly at Mohammad Agha and Tangi Stations. Application of 18 kgs of nitrogen/j compared to the control treatment increased the yield of wheat significantly at the Baraki, Mohammad Agha and Tangi Stations. Application of 18 kgs of nitrogen and five kgs of phosphorus compared to five kgs of P or 18 kgs of nitrogen increased the yield of wheat at the Mohammad Agha, Moqur, Tangi and Gardez Stations. Application of 24 kgs of nitrogen and five kgs of phosphorus/j compared to five kgs of phosphorus and 18 kgs of nitrogen/j increased the yields of wheat significantly only at the Baraki Station. Likewise, application of 24 kgs of nitrogen and eight kgs of phosphorus compared to 24 kgs of nitrogen and five kgs of phosphorus/j increased the yield of wheat significantly only at the Mohammad Agha Station. Application of 30 kgs of nitrogen and eight kgs of phosphorus /j compared to 24 kgs of nitrogen and eight kgs of phosphorus/j increased the yield of wheat only at the Baraki Station. Potassium fertilizer did not increase the yield of wheat at any of the stations during the third year of this study. The data collected from this three-year study regarding potassium application did not compare well with the data reported by the Ministry of Agriculture and Land Reform (1,2,3), but cor esponded very well with the data obtained by Samin and Nielson. (9,11).

During 1994-95, application of 6 kgs of phosphorus/j compared to the control treatment increased the yield of wheat significantly at Baraki, Mohammad Agha, Ghazni Centre and Gardez Stations. Application of 12 kgs of phosphorus /j compared to six kgs of phosphorus/j increased wheat yield at Baraki, Mohammad Agha, Moqur, Ghazni Centre and Gardez Stations. The highest yield of wheat is obtained at all stations except that for one in Herat by applying 36 kg of N/j.
The mean values of wheat yield as influenced by the fertilizer treatments in Tangi and Moqur are reported in table number XI.

Table: XI

Mean values of wheat yield (seers/j) as influenced by the fertilizer treatments in Tangi of Wardak and Moqur of Ghazni provinces during 1991-92

Fertilizer Treatment	Yield in seers/j in Tangi	Yield in seers/j in Moqur
N0P0	84.85 ABC	42.93 F
N0P1	57.51 CD	66.86 E
N0P2	54.80 D	66.45 E
N1P0	92.26 AB	47.36 F
N1P1	56.62 CD	95.0 CD
N1P2	60.80 CD	98.06 BCD
N2P0	97.56 A	45.62 F
N2P1	69.85 BCD	85.09 D
N2P2	61.32 CD	112.59 AB
N3P0	73.0 ABCD	41.97 F
N3P1	60.76 CD	106.39 ABC
N3P2	60.09 CD	116.34 A
N3P2 K	69.79 BCD	105.42 ABC

Note: Mean values of three replications in Tangi of Wardak and Moqur of Ghazni province. Any two means in the same column not followed by the same letter are significantly different at the 5% level of probability.



A view of wheat data collection at Ghazni Center.

At the Moqur Station, the top yield was obtained by the application of 30 kgs of nitrogen and eight kgs of phosphorus/j but the yield of 24 kgs of nitrogen and eight kgs of phosphorus was not significantly lower than that of 30 kgs of nitrogen and eight kgs of phosphorus/j. The response of wheat to fertilizer application was not good at the Tangi Station, because the yield of the control treatment was significantly higher than most other treatments.

Generally, the yield of wheat in the Moqur Station was higher than the Tangi Station.

The mean yield values of wheat as influenced by the varieties and fertilizer treatments at Tangi Station are reported in table number XII.

Table XII

Mean yield values of wheat (seers/j) as influenced by the varieties and the rates of fertilizers at Tangi Station during 1991-92

Rate of Elements N.P.K.			Pak-81	PS-85	Attay-85	Shaghasti	Cartaya	Local	Mean
N0	P0		41.81	37.86	48.24	30.33	33.90	65.43	42.93
N0	P1		65.67	44.24	87.76	62.14	48.24	94.76	62.14
N0	P2		45.95	60.90	62.24	89.57	54.67	85.33	66.44
N1	P0		38.64	28.07	53.33	47.52	41.24	68.83	46.27
N1	P1		74.52	45.19	140.19	128.52	70.14	111.43	95.00
N1	P2		80.52	75.05	127.90	139.19	71.38	94.33	98.14
N2	P0		32.29	20.90	58.81	65.86	35.38	60.48	46.62
N2	P1		55.43	62.57	124.76	96.33	63.62	107.86	85.10
N2	P2		64.43	112.24	174.05	129.14	63.05	132.67	112.60
N3	P0		40.76	28.81	32.50	60.19	22.48	67.10	41.97
N3	P1		79.33	94.95	148.05	124.00	82.90	109.10	106.39
N3	P2	0	91.71	111.90	174.00	119.33	72.03	130.62	116.60
N3	P2	K	79.38	67.86	171.43	119.16	88.05	106.62	105.42

From table XII we can see that the top average yield of wheat was produced by application of 30 kgs of nitrogen and 8 kgs of phosphorus/j. The second average top yield was produced by the application of 24 kgs of nitrogen and 8 kgs of phosphorus/j.

The lowest yield of wheat was produced by the application of 30 kgs of nitrogen/j. It is clear that the nitrogen application without phosphorus is not economical at the Tangi Station.

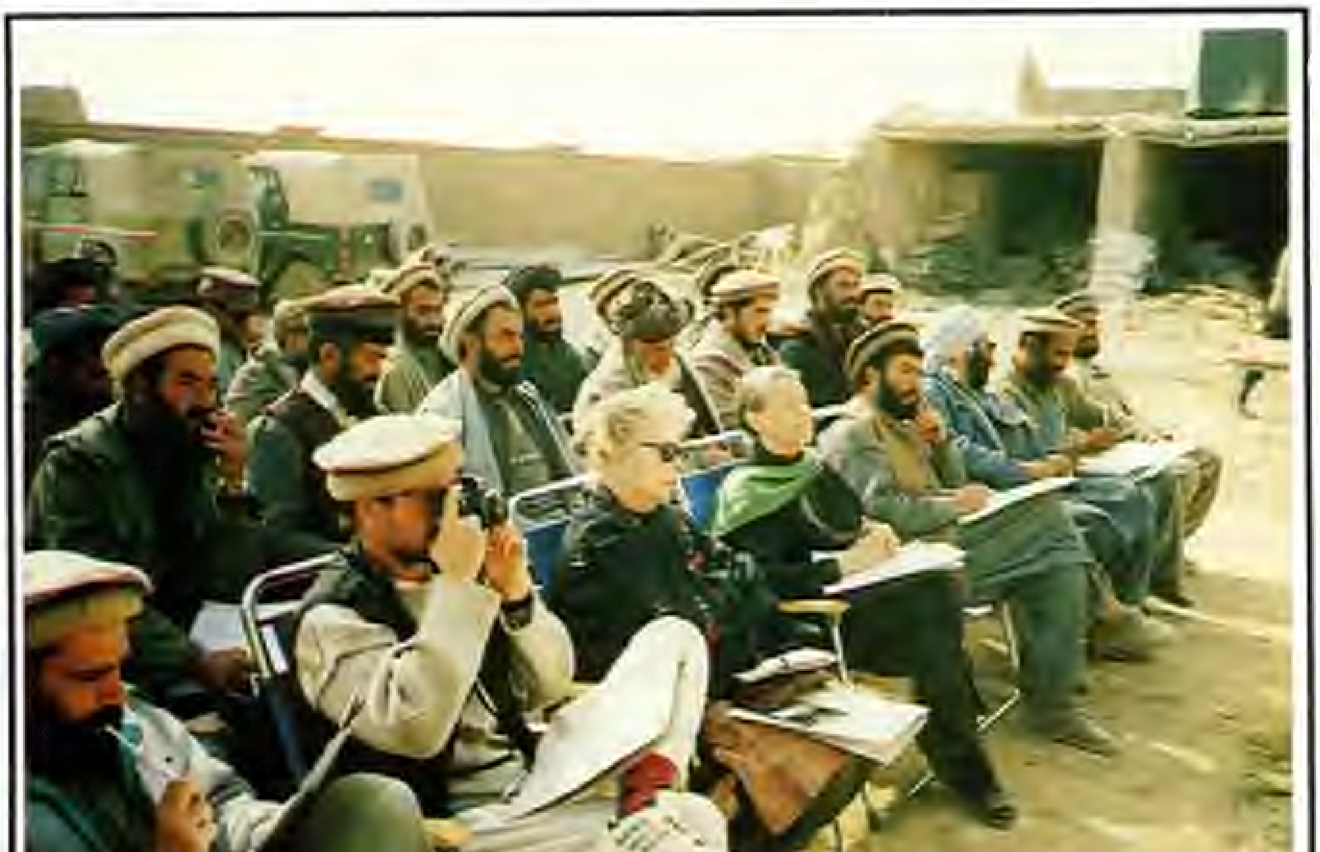
The mean yield values of wheat as influenced by fertilizer treatments are reported in table number XIII.

Table XIII

Mean yield values of wheat (seers/j) as influenced by the fertilizer treatments during 1992-93

Treatment	Baraki	Mohammad Agha	Moqur	Chardiwal	Tangi	Mean
N0P0	52.71 D	35.29 E	16.43 E	1.57 D	43.29 D	23.86
N0P1	50.86 D	48.00 C	20.57 C	2.29 C	48.14 CD	33.97
N1P0	52.00 D	40.00 D	18.43 D	3.43 AB	48.43 CD	31.34
N1P1	80.56 B	58.57 A	24.71 B	3.00 B	57.57 B	44.88
N2P1	83.43 B	53.71 B	25.57 B	3.43 AB	62.86 A	45.76
N2P2	90.29 A	59.86 A	26.57 B	4.00 A	50.86 C	46.32
N3P2	89.14 A	59.43 A	26.56 B	3.29 AB	57.29 B	47.27
N3P2 K	91.57 A	61.42 A	29.00 A	3.71 AB	56.43 B	48.43
Mean	73.82	52.04	23.48	3.09	53.11	41.11

Mean values of three replications in Logar, Ghazni and Wardak provinces. Any two means in the same column and not followed by the same letter are significantly different at the 5% level of probability.



A view of the participants in AAEC's third conference in Baraki Rajan in Logar province October 1993.

From table XIII we can see that the top average yield was produced by the application of 30 kgs of nitrogen, eight kgs of phosphorus and 14 kgs K /j. The second top yield was produced by the application of 30 kgs of nitrogen and eight kgs of phosphorus/j. The lowest yield was obtained by the control treatment.

Generally, the economical yields of wheat in Baraki was produced by application of 24 kgs of nitrogen and 8 kgs of phosphorus/j.

The economical yields of wheat in Tangi was produced by application of 24 kgs of nitrogen and 5 kgs of phosphorus/j while, the economical yields of wheat in Mohammad Agha was produced by application of 18 kgs of nitrogen and 5 kgs of phosphorus/j.

Generally, the highest wheat yield was obtained in Baraki of Logar and the lowest yield was obtained in Chardiwal in Ghazni province.

The mean yield values of wheat as influenced by fertilizer treatments are reported in table number XIV.

Table XIV

Mean yield values of wheat (seers/j)as influenced by the fertilizer treatments during1993-94

Treatment	Baraki	Mohammad Agha	Moqur	Tangi	Gardez	Zormat	Mean
N0P0	80.5 D	49.4 E	45.5 C	63.1 E	45.0 C	5.6 B	48.2
N0P1	81.8 D	58.2 D	48.4 C	71.1 D	48.7 C	5.4 B	50.9
N1P0	89.0 C	60.8 D	49.9 C	79.1 C	43.7 C	4.9 B	54.6
N1P1	89.6 C	80.0 BC	59.7 B	100.0 AB	54.6 AB	5.9 B	65.0
N2P1	97.2 B	76.1 C	59.2 B	104.9 A	55.3 AB	5.4 B	66.4
N2P2	93.5 BC	87.7 A	60.8 AB	96.8 A	59.7 A	5.5 B	67.3
N3P2	103.5 A	84.0 AB	64.5 A	103.1 A	45.1 C	7.1 A	67.9
N3 P2k	97.0 B	87.0 A	62.4 AB	94.5 B	44.6 C	7.3 A	65.5
Mean	91.51	79.90	56.3	89.10	49.60	5.88	74.46

Note: Mean value of three replications in Logar, Ghazni, Wardak and Paktia provinces. Any two means in the same column and not followed by the same letter are significantly different at the 5% level of probability.

The top average yield (91.51kgs/j) was produced in Baraki in Logar province and followed by Tangi in Wardak province. The lowest yield (5.88kgs/j) was produced in Zormat in Paktia province. In Baraki and Moqur Stations the top yields were produced by the application of thirty kgs of nitrogen and eight kgs of phosphorus/j. In Mohammad Agha and Gardez the top yields were produced by the application of twenty-four kgs of nitrogen and eight kgs of phosphorus/j. In Tangi the most economical yield was produced by the application of twenty-four kgs of nitrogen and five kgs of phosphorus/j.Generally, the lowest yield was produced by the control treatment. The Mean yield values of wheat as influenced by the varieties and fertilizer rates in Tangi are reported in table number XV.

Table: XV

Mean yield values of wheat (seers/j) as influenced by the varieties, rates and types of fertilizers in Tangi district of Wardak province during 1992-93

Rate of Fertilizer Elements (N.P.K.)		Pak 81	Ps 85	Attay 85	Shaghasti	Afghan 14	T.MUT	Zardana	Darul-Aman4	Local	Mean
N0	P0	73.3	44.5	58.1	121.9	67.3	102.4	58.8	78.0	70.8	75.1
	P1	69.1	116.7	95.1	110.3	107.3	86.8	131.0	50.9	99.3	96.9
N1	P0	109.7	88.4	141.4	85.1	116.3	56.4	104.7	98.4	72.0	96.9
	P1	70.9	105.8	204.2	154.9	144.2	116.9	81.9	49.4	107.3	115.1
N2	P1	109.0	137.8	215.8	144.6	112.2	127.0	101.9	73.8	108.6	125.6
	P2	58.8	84.3	132.0	166.0	102.4	149.6	86.4	89.0	47.8	101.8
N3	P2	69.5	126.5	172.0	141.9	107.0	96.8	106.3	79.3	132.0	114.6
	P2 K	76.0	152.3	93.4	95.0	89.5	158.5	179.3	68.6	103.0	112.8
Mean		79.54	107.04	139	127.46	105.78	111.80	106.29	72.43	92.60	

Generally, the highest yield of wheat was produced by Attay-85, while, the lowest yield was produced by Darulaman-4. Attay-85 produced the highest yield when eighteen kgs of nitrogen and five kgs of phosphorus/j were applied. Twenty-four kgs of nitrogen and five kgs of phosphorus/j seems to be the best rate of fertilizer. The lower yield was produced by the control treatment. Potassium application increased the yield of PS-85, T-MUT and Zardana.

The mean yield values of wheat as influenced by the varieties and fertilizer rates at Moqur Station are reported in table number XVI.

Table XVI

Mean yield values (seers/j) of wheat as influenced by the varieties and fertilizer rates and types in Moqur in Ghazni province during 1992-93

Rate of Fertilizer Elements		Pak 81	Ps 85	Attay 85	Shaghasti	Afghan 14	T-MUT	Zardana	Darul Aman-4	Local	Mean
N0	P0	24.5	28.2	31.2	31.9	25.5	20.3	43.7	38.1	53.0	32.93
	P1	36.0	47.2	42.5	39.6	36.7	37.1	46.4	46.1	37.8	41.04
N1	P0	35.1	37.8	29.8	34.3	24.0	50.1	46.0	23.0	52.5	36.96
	P1	50.0	45.7	38.0	46.0	55.5	36.9	69.4	48.9	54.0	49.38
N2	P1	48.2	50.7	54.8	42.8	24.1	71.7	69.3	46.2	52.4	51.13
	P2	74.4	50.2	73.3	34.6	43.7	65.0	68.5	69.8	57.9	57.71
N3	P2	42.9	48.2	61.4	37.9	49.6	71.2	59.7	42.2	67.7	53.42
	P2K	36.2	48.1	55.8	50.8	54.2	57.2	95.4	70.5	45.5	57.10
Mean		43.41	44.41	48.35	39.74	39.16	51.19	53.63	62.30	52.6	

The top yields of wheat were produced by Darulaman-4, Zardana, local and T-MUT respectively and the lowest yield was produced by using Afghan-14.

The highest yields of Attay-85 and Pak-81 wheat were produced by the application of twenty four kgs nitrogen and eight kgs of phosphorus/j. The local variety produced the highest yield by application of 30 kgs of nitrogen and eight kgs of phosphorus/j, and the lowest yield of wheat was obtained by the control treatment. Potassium application increased the yield of Zardana, Shaghasti and Darulaman-4.

The mean yield values (seersj) of wheat as influenced by the rate and types of fertilizer in Logar, Wardak, Ghazni, Paktia and Herat provinces during 1994-95 are reported in table XVII.

Mean yield values (seers/j) of wheat as influenced by the rates and types of fertilizer in Logar, Wardak, Ghazni, Paktia and Herat provinces during 1994-95

Rate of Nitrogen & Phosphorus		Baraki (Logar)	Mohammad Agha (Logar)	Moqur (Ghazni)	Ghazni Center	Shash Qala (Wardak)	Gardez (Paktia)	Herat Center
N0	P0	30.45F	28.43G	68.68C	132.21D	18.54C	23.95F	46.96G
	P1	51.43D	38.81F	74.73C	125.72E	32.96B	42.55E	50.09FG
	P2	59.42C	51.57D	68.55C	145.03C	33.92B	47.35D	53.06F
N1	P0	50.53D	49.94E	92.96AB	154.61B	17.69C	39.33E	66.53E
	P1	46.45E	52.28D	95.06AB	150.84B	31.62B	46.46D	78.22C
	P2	59.45C	67.44B	90.05B	151.69B	37.56A	59.90B	86.42B
N2	P0	62.32C	62.18C	93.50AB	150.95B	19.39C	57.92B	72.33D
	P1	66.24B	60.77C	91.92B	151.39B	33.47B	45.60C	90.40A
	P2	98.93A	96.48A	99.65A	160.51A	39.11A	90.27A	89.90A

Note: Mean values of three replications in Logar, Wardak, Ghazni, Paktia and Herat provinces. Any two means in the same column and not followed by the same letter are significantly different at the 5% level of probability.

Generally, the lowest wheat yield was produced by application of no fertilizer. The highest wheat yield at all of the stations except the one in Herat was obtained by applying 36 kgs of nitrogen and 12 kgs of phosphorus/j. Th highest wheat yield in Herat was obtained by applying six kgs of phosphorus and 36 kgs of nitrogen/j.

The results from an economical analysis of wheat yield are reported in table XVIII.

Generally, the best yield of wheat during 1991-92 at the Moqur Station was obtained by applying 24 kgs of nitrogen and 8 kgs of phosphorus/j, while, the highest yield during the same year at the Tangi Station was obtained by applying only 24 kgs of nitrogen/j.

During 1992-93 the highest wheat yield at Moqur, Baraki and Mohammad Agha Stations were obtained by applying 24 kgs of nitrogen and 8 kgs of phosphorus/j, but at Tangi Station the highest yield of wheat was obtained by applying only 24 kgs of nitrogen and 5 kgs of phosphorus/j. At the same station even during the third year of the study, the highest yield of wheat was obtained again by using 24 kgs of nitrogen and 5 kgs of phosphorus/j. Fertilizer application at the Tangi Station compared to other stations clearly showed that the fertility level of the soil at the Tangi Station is high, therefore, there was not a good response of wheat to high rates of the nitrogen fertilizer.

During the third year, generally the highest yield of wheat at the Moqur, Mohammad Agha and the Gardez Stations were obtained by applying 24 kgs of nitrogen and 8 kgs of phosphorus/j, but at the Baraki Station the highest yields of wheat was obtained by applying 30 kgs of nitrogen and 8 kgs of phosphorus/j.

The most economical yield was obtained at the Baraki Station (1992-93), where 24 kgs of nitrogen and 8 kgs of phosphorus/j were applied. For each Afghani spent on fertilizer, a net income of Afs. 7.0 was obtained and for each kg of plant nutrient applied, 17.5 kgs of wheat was obtained (table XVIII). The second economical rate of fertilizer was 24 kgs nitrogen and 8 kgs of phosphorus/j at the Moqur Station (1991-92).For each Afghani spent on fertilizer, a net income of Afs. 6.4 was obtained and for each kg of plant nutrient applied, 16.3 kgs of wheat was obtained.



A view of different wheat varieties growth. The seeds were provided by FAO through CIMMYT in Baraki Rajan in Logar province in 1993.

The economical analysis of the wheat yields during 1991-94 is reported in table number XVIII.

bread and the quality of its straw requires further studies as well, because the cost of the straw is very high (up to Afs. 750/seer. Currently the wheat price in the concerned area is up to Afs. 7,500/seer).

Wheat is planted traditionally in Afghanistan with a wooden sowing plough. It is worth mentioning that some farmers are using tractors for land preparation. Wheat harvest is done mainly by the use of a sickle. Threshing of the wheat in most parts of the country is done traditionally by using oxen (mainly), donkeys and horses. Those using tractor operated threshers are still very few but their numbers are increasing, especially in the areas where most of their draught animals have been lost.

Afghan soils are mainly low in nitrogen, phosphorus and organic matter. Nitrogen and phosphorus fertilizer application has increased the yield of wheat significantly in most parts of the country (9,11).

In 1991, AAEC launched a program of variety/fertilizer trials on wheat. The objectives of the project are listed below:

1. To find out the appropriate types of seed for each of the concerned areas.
2. To find out the appropriate types and ratios of fertilizers for each of the concerned areas.
3. To improve the agriculture skills of the farmers, for each of the concerned areas.
4. To increase the yield and improve the quality of wheat.



Discussion between CoAR and NAC's representatives at Moqur in Ghazni province regarding the establishment of Afghan Agriculture Experimental Center (A.A.E.C) in 1991.

Table XVIII

Economical analysis of the wheat yields during 1991-94

Place	Year	Treat ment	Yield in Kgs / Jerib		Cost of Fertilizers In Afs/j	Increased in Yield			Net Return		
			Unfertilized	Fertilized		Amount in Kgs/j	%	Afs./j	Afs./j	Per Af.	Per kg of Plant Nutrient
Moqur	91-92	N2P2	300.5	788.2	66,000	488	162	488,000	422,000	6.4	16.3
Tangi	91-92	N2P0	593.7	688.5	48,000	95	16	95,000	47,000	1.0	4.0
Moqur	92-93	N2P2	230.5	406.0	66,000	176	76	176,000	110,000	1.7	5.9
Tangi	92-93	N2P1	525	879.4	57,000	354	67	354,000	297,000	5.2	13.1
Baraki	92-93	N2P2	738.2	1263.5	66,000	525	71	525,000	459,000	7.0	17.5
Mohd. Agha	92-93	N2P2	837.9	1193.5	66,000	356	42	356,000	290,000	4.4	11.9
Moqur	93-94	N2P2	318.6	451.6	66,000	133	42	133,000	670,000	1.0	4.4
Tangi	93-94	N2P1	441.9	734.2	57,000	292	66	292,000	235,000	4.1	10.8
Baraki	93-94	N3P2	563.4	724.4	78,000	161.0	29	161,000	830,000	1.1	4.5
Mohd. Agha	93-94	N2P2	345.7	613.8	66,000	268	78	268,000	202,000	3.1	8.9
Gardez	93-94	N2P2	315.1	417.6	66,000	103	33	103,000	64,000	1.0	3.4

Assumed prices in Afs./kg : N,2,000; P,3,000; wheat 1,000, One US$ approximately 6,000 Afs.

The average number of ears/sqm, the number of grain/ear, the weight of 200-grains and the yield of wheat (seers/j) at Moqur and Tangi Stations from the complex experiment (1991-92) are given in table number XIX.

Table: XIX

The number of ears/sqm, the number of grains/ear and the weight of 200 grains of wheat at the Moqur and Tangi main stations during 1991-92

	Pak-81	Ps-85	Attay-85	Shaghasti	Cartaya	Local
Number of ears/sqm	118	121	341	171	98	304
Number of grains/ear	46	42	54	55	41	27
Weight of 200 grains in grams	7.2	8.0	7.8	8.6	7.2	4.8
Calculated Yield in Seers/Jerib	55.8	58.1	205.2	155.5	41.3	56.3
Rank	(5)	(3)	(1)	(2)	(6)	(4)

Generally, the top yield during the first year of the experiment was produced by Attay-85, while, Shaghasti variety produced the second top yield. PS-85 produced the third top yield but Cartaya produced the lowest yield.

Attay produced the first top number of ears/sqm and the local variety produced the second top number of ears/sqm but Cartaya produced the lowest number of ears/sqm.

The weight of 200 grains was the highest for Shaghasti and the lowest for local variety.

The calculated yield compared to the real yield (Table XIX) is an indication of the reliability of these experiments. In this case we may say the reliability is quite good.



A view of AAEC third conference in Baraki Rajan in Logar province. The GCG consultant is explaining the adaptation of different varieties of wheat in Afghanistan.

The mean yield values of wheat on some sub-stations as influenced by the varieties and time are reported in table number XX.

Table: XX

Mean yield values of wheat (seers/j) on sub-stations as influenced by the varieties and time during 1993-94

Year	No. of Sub-stations	Pak-81	Ps-85	Attay-85	Shaghasti	Afghan-14	T-MUT	Zardana	D-4	Local
92-93	19	62.0	61.6	81.8	64.4	63.1	58.7	70.7	59.9	59.3
93-94	12	59.4	59.7	65.6	51.8	59.2	63.1	64.0	54.3	59.7
Mean yield seers/j		60.7	60.7	73.7	58.1	61.2	61.2	61.9	67.4	59.5
Rank		(5)	(5)	(1)	(8)	(4)	(3)	(2)	(9)	(7)

The highest yields in both years were obtained by using Attay-85 and Zardana produced the second top yield. The lowest yield was obtained by using Darulaman-4, Shaghasti and local varieties respectively.

The results obtained for the sub-station confirm the results obtained on the main stations which also confirm the reliability of the observations.

The effects of fertilizer treatments on the sub-station during 1993-94 are reported in table XXI.

Table XXI

Mean yield values of wheat (seers/j) on 12 sub-stations as influenced by the rate of fertilizers during 1993-94

Treatments		N1PO	N1P1	N2P1	N2P2	N3P2	N3 Pak
Mean yields in (seer/Jerib)	42.1	51.1	49.8	68.4	69.5	63.0	66.9
Rank	(7)	(5)	(6)	(2)	(1)	(4)	(3)

The highest yield of wheat was obtained by application of twenty-four kgs of nitrogen and eight kgs of phosphorus/j.

The second top yield was produced by application of twenty-four kgs of nitrogen and only five kgs of phosphorus/j.

The lowest wheat yield was obtained from the plots which did not receive any fertilizer. The results of the sub-stations totally agree with the results of the main plots (complex).

The average yields, weight of two hundred grains, number of ears/sqm, height, percentage of bird and leaf rust damages of nineteen sub-stations during 1992-93 are repeated in table number XXII.

Table: XXII

Mean yields of wheat (seers/j), weight of 200 grains, number of ears/sqm, height, percentage of bird and leaf rust damages on 19 sub-stations during 1992-93

Variety	Seer/j	Weight of 200 Grains in Grams	Number of Ears/sqm	Height in (cm)	% Bird Damages	% Leaf Rust Damages
Pak 81	62.2	7.1	435	68	11.5	0.0
PS - 85	61.7	7.9	208	74	12.8	0.0
Attay 85	81.8	7.0	259	82	1.0	0.0
Shaghasti	64.6	8.0	206	86	2.5	0.0
Afghan 14	63.1	6.8	235	70	10.4	0.0
T-MUT	58.7	7.0	246	82	2.5	0.0
Zardana	70.8	7.8	248	77	1.9	1.9
Darul Aman 4	60.0	7.0	247	86	0.3	0.2
Local	60.4	7.9	261	83	4.2	5.0

The highest yield of wheat was obtained by using Attay-85 followed by Zardana and the lowest yield was obtained by application of T-MUT variety.



A view of the wheat multiplication project at harvest time in Tangi in Wardak province. Tests have shown that Attay-85 is the most suitable variety for local use.

The weight of 200 grains was the highest for Shaghasti followed by the local and PS-85 varieties and the lowest with T-MUT.

Shaghasti and Darulaman-4 were the tallest varieties but Pak-81 was the shortest variety. The percentage from bird damage was the highest for PS-85 followed by Pak-81 and the lowest for Darulaman-4.

The percentage of damage from leaf rust was the highest for local variety followed by Zardana variety.

Summary and Conclusion

Determining the optimum fertilizer rates and finding the adapted varieties of wheat as well as the other crops grown under various soil and climatic conditions of Afghanistan is a project that can never be fully completed. Results may not be extended, for example, from one variety Pak-81 to Attay-85 or from the Moqur Station to the Tangi Station or even from one year to another year especially where nitrogen is concerned.

The reader is reminded that the results of this study represents only a four-year trial of varieties of wheat and fertilizer types and rates. Strong conclusions should therefore not be drawn. The work needs to be continued in the years to come with more stations and more varieties.

Generally, the Attay-85 has produced the highest yields in Logar, Wardak and Ghazni provinces.

Shaghasti has produced the second top yield during this study.

Zardana has produced the second to third top yields during the last three years of the study. The yield of the local variety was not significantly lower than that of Pak-81, PS-85, Darulaman-4 and Afghan-14 (Table VIII). It is worth mentioning that Shaghasti has produced the second top yield during the four years of this project.

Attay-85, Shaghasti and Zardana can be recommended as the three top yielding varieties. True winter varieties of the wheat are needed for such areas as Logar, Ghazni and Wardak provinces. During the three years of this study, the highest yield was produced by applying 24-30 kgs of nitrogen and 8 kgs of phosphorus/j. Applying 24 kgs of nitrogen and 8 kgs of phosphorus/j was the best rate of fertilizer at the Moqur, during the first and third years, at the Mohammad Agha Station during two years and the Gardez and Baraki Stations during their first year. Application of 30 kgs of nitrogen and eight kgs of phosphorus/j was the best rate of fertilizer at the Baraki Station during the second year and Zormat Station during its first year of application. The best yields of wheat at the Tangi Station during the second and third years were obtained by applying only 24 kgs of nitrogen and five kgs of phosphorus/j respectively.

Generally, the top yield during 1991-94 (Table XVII) was produced in Baraki Rajan in Logar province. The highest net income was obtained by applying 24 kgs of nitrogen and 8 kgs of phosphorus/j at the Baraki Rajan Station. During its first year of application in which a net income of Afs. 7.0 was obtained for each Afghani spent on fertilizer and for each kg of plant nutrient used, 17.5 kgs of wheat was obtained. The second economical wheat yield was obtained by applying the same rate of fertilizer, at the Moqur Station during the first year of this study in which the net income of Afs. 6.4 was obtained from each Afghani spent on fertilizer, each kg of the plant nutrient produced 16.3 kgs of wheat. During 1994-95 the highest wheat yield at all of the stations except the one in Herat was obtained by applying 36 kgs of nitrogen and 12 kgs of phosphorus/j. The best yield in Herat was obtained by applying 36 kgs of nitrogen and 6 kgs of phosphorus/j. Generally, 24-36 kgs of nitrogen and 6 kgs of

phosphorus/j can be recommended as the best rate of fertilizer in all of the stations expect for the Tangi and Herat (one year study) Stations. At the Tangi Station, 24 kgs of nitrogen and 5 kgs of phosphorus/j seems to be the best rate of fertilizer.

SOURCES CITED

1. Indo-Afghan Annual Report of Agriculture Research Project, 1972.

2. Indo-Afghan Report of Agricultural Research Project, 1973.

3. Indo-Afghan Report of Agricultural Research Project, 1975.

4. Carter, D.P. 1966. Harvest Results of Extension Farmer Demonstration in Helmand Valley Authority, USAID, Agriculture, Bost, Afghanistan.

5. Hauser, G. 1951. Report on Laboratory Work. FAO, Kabul, Afghanistan.

6. Mula Khel, 1978. Commercial Fertilizers, Ministry of Agriculture, Publication Series.

7. Nielsen, G.A and Samin A. Q., 1966. Use of Fertilizer for High Yields, Mimeographed Presentation at the Ministry of Agriculture, Research and Extension Division, Extension Training Course On Wheat, Kabul, Afghanistan.

8. Royal Government of Afghanistan, Meteorological information from the Logar, Ghazni, Paktia and Khost Stations. Unpublished data.

9. Samin, A.Q. and Nielson, 1967. Fertilizer trials On Wheat in Afghanistan. Technical Bulletin # 1. Kabul University Publication.

10. Samin, A.Q. and Zaghard M.A., 1981. Soil Chemistry And Plant Nutrition. Kabul, University Publication.

11. Samin, A.Q., 1977. Fertilizer trials On Wheat In Laghman and Nangarhar Provinces. Technical Bulletin #31 Faculty of Agriculture, Kabul, University Publication.

12. Shuman, F.M., 1959. Report of the Response of Wheat to Fertilizer Village Trails. ICA Report Kabul, Afghanistan.

13. Walkup, H.W. et.al. 1968. The Role of Fertilizer in Agricultural Development of Afghanistan, Tennesse Valley Authority. National Fertilizer Development Center, Muscle Shoals, Alabama.

14. Winch, 1989. Where There is No Farmer. ICRC, Peshawar, Pakistan (unpublished data).

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Fertilization of Wheat in Afghanistan

Nitrogen and phosphorus are apparently deficient in most agricultural soils of Afghanistan (9,11). Only a few of the soils have actually been tested for available phosphorus and total nitrogen. However, observations for deficiency symptoms in plants and results of small fertilizer trials dating back to 1951 to 1978 suggest that the shortage of nitrogen and phosphorus in Afghanistan soils restricted yields and thereby impeded agricultural development.

Hauser (5) conducted field projects in several provinces of Afghanistan and analyzed numerous soil samples in the laboratory. He stated the following:

1) *Nitrogen is a limiting factor of production in most Afghan soils.*
2) *Application of phosphorus alone to soil low in nitrogen will not increase the yield.*
3) *Application of phosphorus on soils rich in nitrogen is beneficial.*
4) *Potassium is not a limiting factor in most Afghan soils.*
5) *Soils having more than 5 ppm of water soluble phosphate will have an adequate supply of phosphorus for a good yield. Most soils in the Kataghan area contain less than 5 ppm of water soluble phosphate and therefore need phosphate fertilization. One or two heavy applications of local fertilizers (night soil and ashes) on Kataghan soil did not correct the phosphorus deficiency.*

Shuman (12) noted phosphorus and nitrogen hunger signs in most wheat fields in Kabul province. He felt that increased yields were dependent upon increasing the supply of these nutrients in the soil.



A view of a discussion at the Moqur Conference regarding the ***Foundation for Rural Development*** *in October 1991.*

Carter (4) reported that 8.2 kgs of nitrogen and 4.1 kgs of P_2O_5 per jerib increased the yield of wheat in the Helmond Valley an average of 68.1 kgs/j or 22%. In his instructions, he recommended 18.2 kgs of nitrogen and 9.1 kgs of phosphorus /j. He suggested that the fertilizer should be spread evenly over the plot after the first ploughing. The second ploughing, opposite in direction to the first, mixed the fertilizer with the soil.

Nielsen and Samin (7) tentatively recommended 15 kgs nitrogen and 5 kgs of phosphorus/j, where wheat is planted on infertile soils in the Kabul area. Until further research results become available, they suggested all of the phosphorus and half of the nitrogen should be worked into the soil at planting time. The other half of the nitrogen was spread on the top of the soil during or just before the spring rain or the first irrigation during the spring, before the wheat reaches a height of 30 cm.

Afghan Fertilizer and Agricultural Services Corporation as reported by Samin and Zaghard (10) has recommended 20 kgs of nitrogen and 4 kgs of phosphorus/j for wheat throughout Afghanistan. At a later date, Mula Khel (6) recommended 22 kgs of nitrogen and 12 kgs of phosphorus /j in Kabul, Logar, Paktia, Wardak and Ghazni provinces.

Winch (14) has recommended 24 kgs of nitrogen and 10 kgs each of phosphorus and potassium oxide/j of wheat.Samin (11) stated that:

1) *Nitrogen and phosphorus are presently the basic limiting factors for wheat production in most Afghan soils.*

2) *Application of phosphorus alone to soils low in nitrogen will not increase wheat yield significantly.*

3) *Application of phosphorus on soils rich in nitrogen or with nitrogen fertilizer is beneficial.*

4) *Soils having more than 6 ppm of available phosphorus will have an adequate supply of phosphorus for a good yield.*

5) *Potassium is not a limiting factor in most Afghan soils for wheat crop.*

6) *Application of animal manure is needed for a good yield and a better physical condition of the soils in most parts of the country.*

7) *Money spent on fertilizer will give a greater return than many other investments in Afghanistan. He added that it would be more economical to bring one truck of fertilizer rather than five or more trucks of wheat, because each kg of plant nutrient has increased the yield of wheat from 4.0 to 22.7 kgs at the Baghlan Station. In Kabul the yield increase ranged from 5 to 10.2/kg of plant nutrient (9).*

Samin and Nielson (9) stated that in Baghlan, the addition of only 5.6 kgs of nitrogen/j increased wheat yield by 37.7 % and a net return of Afs. 847/j was obtained from 5.6 kgs of nitrogen and 6.2 kgs of phosphorus/j, while 17 kgs of nitrogen and 14.4 kgs of phosphorus/j increased the yield of wheat 104%.

Ministry of Agriculture and Land Reform (1,3) conducted a two-year wheat experiment program in Wardak, Logar, Ghazni, Baghlan, Kunar, Kapisa and Parwan provinces. The rate of fertilizer was 0, 15 and 30 kgs each of nitrogen and phosphorus pentaoxide at

different combinations. The highest yield (58 seers/j) of the control treatment was obtained in Wardak province. Application of 15 kgs of phosphorous pentaoxide/j compared to the control treatment increased the yield of wheat at all of the concerned stations. Application of 15 kg of nitrogen/j compared to either the control or 15 kgs of phosphorus pentaoxide /j treatments, increased the yield of wheat in all of the stations. Application of 30 kgs each of nitrogen or phosphorus pentaoxide/j compared to 15 kgs each of nitrogen and phosphorus pentaoxide/j increased the yield of wheat in all of the stations except Nangarhar province (only one year). Application of 15 kgs nitrogen, phosphorus pentaoxide and 20 kgs of potassium oxide/j compared to 15 kgs each of nitrogen and phosphorus pentaoxide/j increased the yield of wheat in all of the stations except Nangarhar Station during the first year of the study. Application of 30 kgs each of nitrogen and phosphorus pentaoxide and 20 kgs of potassium oxide/j compared to 15 kgs each of nitrogen and phosphorus pentaoxide increased the yields of wheat in all of the stations.

The same Ministry (1, 2) conducted some other wheat experiments in Herat, Kandahar, Kapisa, Logar, Baghlan, Laghman, Nangarhar, and Kabul provinces. They have applied 12 kgs each of nitrogen, phosphorus pentaoxide and potassium oxide/j at different combinations. Application of 12 kgs each of nitrogen and phosphorus pentaoxide or nitrogen and potassium oxide or phosphorus pentaoxide and potassium oxide/j compared to the control treatment increased the yield of wheat at all of the stations. Application of 12 kgs each of nitrogen, phosphorus pentaoxide and potassium oxide/j compared to either 12 kgs each of nitrogen and phosphorus pentaoxide or 12 kgs of nitrogen and potassium oxide or 12 kgs phosphorus pentaoxide and potassium oxide/j increased the yield of wheat in all of the stations. The reports from the Ministry of Agriculture and Land Reform showed that the application of potassium fertilizer has increased the yields of wheat in most of the stations (1, 2, 3).



The participants in AAEC's first conference in Moqur in Ghazni province in October 1991

EXPERIMENTAL METHODS

Six varieties of wheat (Pak-81, PS-85, Attay-85, Shaghasti, Cartaya and one local variety), four rates of nitrogen (0,18, 24 and 30 kgs per jerib), three rates of phosphorus (0,5,8 kgs per jerib) and two rates of potassium (0 and 14 kgs per jerib) were tested in Tangi of Wardak and Moqur of Ghazni provinces during the year 1991-92. During the year 1992-93 and 1993-94 the variety of Cartaya dropped due to its low yields and replaced by Afghan-14, Darulaman-4 T-Mutant and the Zardana varieties, were added to be tested with the remaining varieties from the year 1991-92 in the Baraki and Mohammad Agha Stations of Logar province, Moqur and Chardiwal in Ghazni province and Tangi in Wardak province. Zormat and Gardez Stations in Paktia province also were included during 1993-94. The treatments of fertilizers changed from 13 to 8 during the second and the third years of the project.

During the year 1994-95 Pak-81 and PS-85 dropped due to their poor adaption (Autmn plating) and replaced by Marious and Bidi-17. Potassium application dropped due to no responce of wheat to potassium fertilizer. The rate of phosphorus were 0, 6 and 12 kg P/j and the rates of nitrogen were 0,18 and 36 kgs N/j.

The rate of seed was 35 kgs/j and all of the untreated seeds were treated with vitavax (two grams per kg of the seeds).

The experiment was composed of 78 treatments during the first year and 72 treatments during the second, third and fourth years in the main station and each of the treatments was replicated three times. There were 234 plots (6 square meters) during the first and 216 plots (6 square meters) during the second, third and fourth years of the study.



A view of weighed wheat seeds and fertilizer bags to be applied in different plots

The design of the four years of experiments was Randomized Complete Block. Analysis of the Variance and the Duncan's Multiple Range Tests were used to find out the significant differences of the yields among different treatments. Along with complex experiments, simpler trials (no replication) were set up in all of the concerned provinces during the first two years of the project.

The areas were ploughed twice, using tractors during the last three years. During the first year oxen were used to plough one treatment in each of the sub-stations (demonstration plots) and the remaining areas were ploughed twice using tractors. The ridges and small ditches were also formed. After preparation of the land, both seeds and fertilizers were broadcast and then covered by the use of racks. The following irrigations were performed by the landlords at the same time as they had irrigated their other fields of wheat.

The main concern in this report was the wheat yields. One random sample (the sample units were chosen entirely by chance or at random), of one square meter from each of the plots was harvested, threshed and weighed. The results of the average yields after the completion of the Analysis of Variance and the Duncan's Multiple Range Test are given in tables IV, V, VI, VII, XI, XIII, XIV and XVII.

The result of mean yields on the sub-station are given in table XX-XXI.

Soil samples were collected from each of the experimental areas before fertilizer was applied. Selected chemical and physical properties were determined through the Department of Soil Science, NWFP Agriculture University, Peshawar. The results are given in tables number II-III.



A view of the wheat seed and fertilizer application process where the Head of Research is guiding the process in Moqur in Ghazni province

Climate:

In general, Afghanistan has arid or semi-arid climate, where the average rain fall overall of Afghanistan varies from 150 to 400 mm/year (8). According to the Central Statistics Office, the average annual precipitation of Wardak, Logar and Ghazni provinces between 1966 and 1976 ranged from 253 to 266mm/year. The climate of these areas is relatively cold with most of the precipitation falling in winter, from January to March and the concerned area is normally enveloped with snow.

A view of daily maximum and minmum temperature recording at G.C.G in Ghazni province



For the time being, most of the registration of the climate parameters area stopped in Afghanistan. Some meteorological information from the concerned areas are given in table number I.

Table: I

Meteorological information from the Logar, Ghazni, Paktia and Khost Stations (8):

Stations	Gardez (Paktia)	Khost	Logar Center	Ghazni Center	Moqur (Ghazni)
Elevation (m)	2350	1146	1935	2183	2000
Period	1964-70	1962-70	1967-70	1959-70	1966-70
Mean Temperature (C°)	9.3	17	10.7	9.5	11.2
Min. Absolute Temperature (C°)	-30.3	-8.5	-35.8	-31.1	-33.0

The climate is characterized with very low precipitation, with approximately 70% between January and April and very low temperatures in winter time.

Soil:

AAEC experiments were established in irrigated areas, representing two different types of Pedagogical conditions:

1. Irrigated plain of silty soils which are originated by wind erosion.
2. Irrigated traces on loam soils with all variations between clay, silty, and sandy loams transported by water. Nitrogen and phosphorus are apparently deficient in most agricultural soils of Afghanistan.

The physio-chemical properties of soil sample are reported in table number II.

FOUNDATION FOR RURAL DEVELOPMENT

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SEED AND FERTILIZER TRIALS

IN GHAZNI, WARDAK, LOGAR, PAKTIA

AND HERAT PROVINCES OF AFGHANISTAN

(1991 to 1995)



A PROGRAMME SUPPORTED BY COORDINATION OF AFGAN RELIEF - CoAR

AFGHAN AGRICULTURE EXPERIMENTAL CENTER (AAEC)

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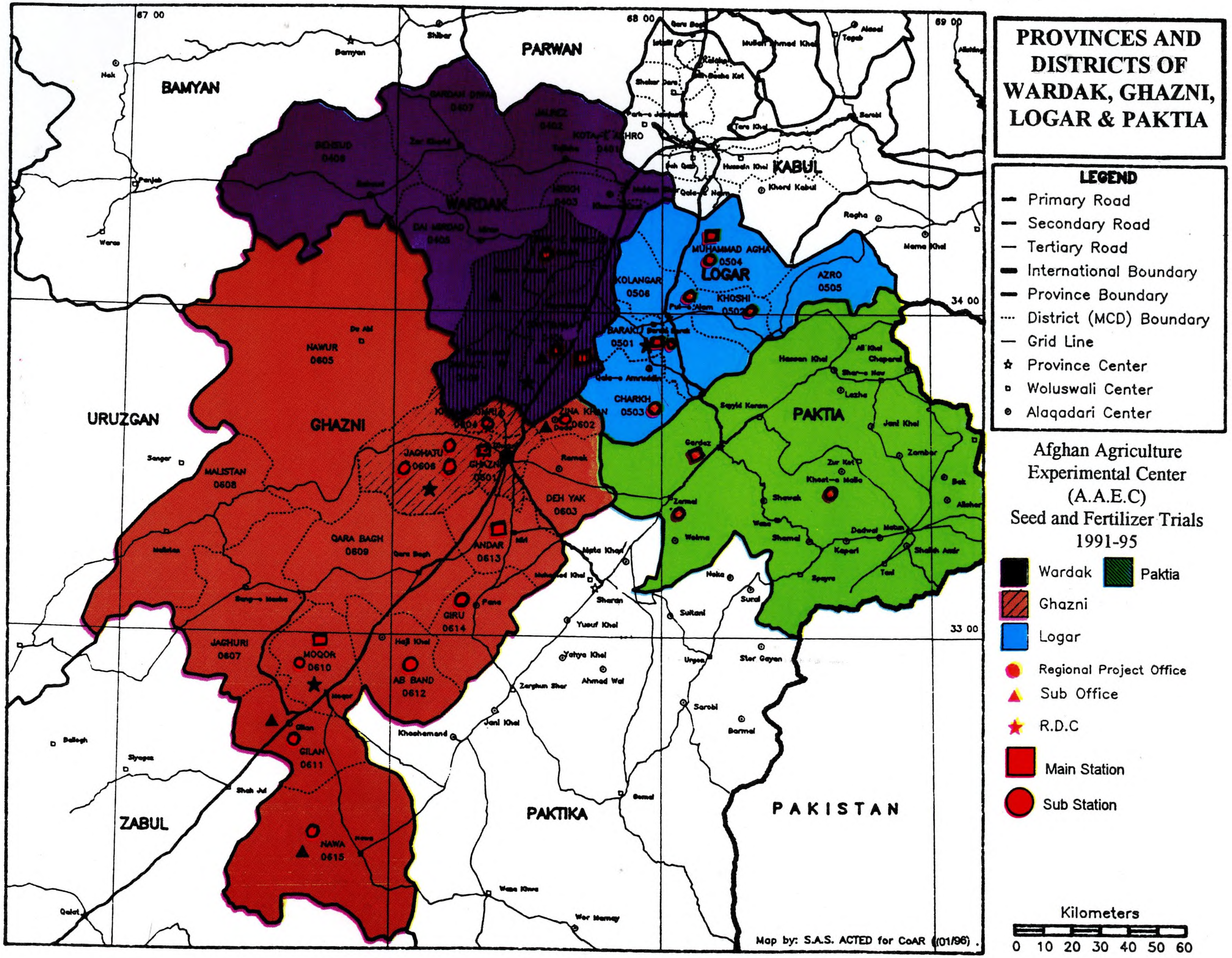
Written by:

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Agriculture Consultant
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Grid Line
Province Center
Woluswali Center
Alaqadari Center
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Wardak
Paktia
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Logar
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R.D.C
Main Station
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Kilometers
0 10 20 30 40 50 60
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PARWAN
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KABUL
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URUZGAN
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67 00
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33 00
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